

# Phalanger lullulae.

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## Phalanger Storr, 1780

- Coescoes* Pallas, 1766:60. Type species: *Didelphis orientalis* Pallas, 1766 by monotypy. [nom. oblit.; name generally attributed to Lacépède, 1801.]
- Phalanger* Storr, 1780:33. Type species: *Didelphis orientalis* Pallas, 1766 by monotypy.
- Phalangista* Geoffroy and Cuvier, 1795:187. Type species: *Didelphis orientalis* Pallas, 1766 by monotypy.
- Ballantia* Illiger, 1811:77. Type species: *Didelphis orientalis* Pallas, 1766 by monotypy.
- Sipalus* Fischer, 1813:581. Type species: *Didelphis orientalis* Pallas, 1766 by monotypy.
- Cuscus* Lesson, 1826:150. Type species: *Didelphis orientalis* Pallas, 1766 by monotypy.
- Spilocuscus* Gray, 1861:316. Type species: *Phalangista maculata* Desmarest, 1818 by subsequent designation (Thomas, 1888).

**CONTEXT AND CONTENT.** Order Diprotodontia, Suborder Phalangerida, Superfamily Phalangerioidea, Family Phalangeridae, Tribe Phalangerini, Genus *Phalanger*. Some authors have included *Ailurops* Wagler, 1830 and *Strigocuscus* Gray, 1861 as synonyms of *Phalanger* (McKay, 1988; Tate, 1945), whilst others have given *Spilocuscus* full generic status (Flannery et al., 1987; George, 1987). However, the monophyly of *Strigocuscus* sensu Flannery et al. (1987) is still in doubt (Norris, 1992; Springer et al., 1990) and inclusion of some of the species of *Strigocuscus* in *Phalanger*, combined with full generic status for *Spilocuscus*, would lead to the creation of a paraphyletic genus *Phalanger* (Norris, 1992). The alternative solution, namely the allocation of a new generic name to the species formerly included in *Strigocuscus*, would be at odds with the apparent molecular conservatism of the phalangerids (Baverstock et al., 1990). Hence, for the purposes of this account, *Spilocuscus* is treated as a subgenus of *Phalanger*. A key to the species of *Phalanger* follows (adapted from Flannery, 1994; Flannery and Boeadi, 1995; Menzies and Pernetta, 1986):

- 1 Inflated frontal bones; ear pinnae hidden in fur (Subgenus *Spilocuscus*) ..... 2
- Frontal bones not inflated; visible ear pinnae ..... 5
- 2 Extensive areas of jet black color on dorsum; head covered in reddish fur ..... 3
- Mottled, spotted, or with absence of jet black coloration on dorsum; fur on head gray, white, orange, or combination of these colors ..... 4
- 3 Length of head and body >500 mm ..... *P. rufoniger*
- Length of head and body <500 mm ..... *P. kraemeri*
- 4 Dark spots on dorsal pelage small and well separated ..... *P. papuensis*
- If present, dark spots on dorsal pelage large, and usually confluent ..... *P. maculatus*
- 5 P4 and p4 massive, deflected outward from toothrow; tail extremely rugose with coarse tubercles ..... *P. gymnotis*
- P4 and p4 smaller, not deflected outwards; tail with fine tubercles or smooth skin ..... 6
- 6 Snout narrow; facial extent of lachrymal reduced; diastema between I3 and C1 ..... 7
- Snout broad; facial extent of lachrymal moderate to extensive; no separation between I3 and C1 ..... 9
- 7 Bright red pelage on shoulders; dorsal stripe restricted to head region ..... *P. alexandrae*
- Gray or tan pelage on shoulders; dorsal stripe runs from head to lower back ..... 8
- 8 Forequarters yellowish tan or brownish red and noticeably lighter in color than hindquarters; profuse white or dark

- spotting may be present on dorsum; white or yellow patch on ventral pelage not extensive ..... *P. ornatus*
- Forequarters and hindquarters uniform in color; spotting never present on dorsum; extensive, well-defined white or yellow ventral pelage ..... *P. rothschildi*
- 9 Dorsal pelage irregularly mottled with brown, ochre, and white; white ventral pelage, with dark irregular spots ..... *P. lullulae*
- No spotting of dorsal or ventral pelage ..... 10
- 10 Fur short to moderately long, <20 mm ..... 11
- Fur moderate to very long, >20 mm ..... 12
- 11 Tail uniformly black in both sexes; fur wedge on tail short ..... *P. intercastellanus*
- Tail with white tip in females; fur wedge of tail extensive ..... *P. orientalis*
- 12 Gray dorsal pelage with broad dorsal stripe ..... 13
- Chocolate brown dorsal pelage with no dorsal stripe ..... 14
- 13 Molar teeth very small; ears short, thinly furred, with no ear flashes; elbows uniformly colored ..... *P. matanim*
- Molar teeth moderately large; ears comparatively long, with white ear flashes; white elbow patches ..... *P. vestitus*
- 14 Tubercles at base of tail ..... *P. carmelitae*
- No tubercles at base of tail ..... *P. sericeus*

## Phalanger lullulae Thomas, 1896

### Woodlark Island Cuscus

- Phalanger lullulae* Thomas, 1896:527. Type locality "Woodlark Island," Papua New Guinea, about 09°09'S, 152°46'E (Laurie and Hill, 1954:159).
- Phalanger orientalis peninsulae* Tate, 1945:2. Type locality "Rocky scrub, 30 miles north of Coen, north Queensland," Australia.

**CONTEXT AND CONTENT.** Context given above. No subspecies of *P. lullulae* are recognized.

**DIAGNOSIS.** The most distinctive feature of *P. lullulae* (Fig. 1) is its pelage: the dorsal fur is irregularly mottled with brown, ochre, and white, whilst the venter is white with irregular dark spotting. The only other taxa of *Phalanger* with mottled fur are the nominate subspecies of *P. ornatus* (Flannery and Boeadi, 1995) and the four species of the subgenus *Spilocuscus*. Absence of any ochreous coloration in *P. ornatus* and the enlarged frontal bones,



FIG. 1. Adult male *Phalanger lullulae* (dark morph), National Museum and Art Gallery, Port Moresby, Papua New Guinea. Photograph by I. Bigilale.

reduced ear pinnae, and great size of the *Spilocuscus* species, combined with the allopatric distribution of *P. lullulae*, make confusion unlikely (Flannery, 1994). Facial skin in *P. lullulae* is black, with a contrasting pink rhinarium. The skull is similar to that of *P. ornatus* but more pear-shaped and widest at the posterior end of the zygomata (Fig. 2). Nasal bones terminate above the ends of the premaxillae, and the paroccipital processes are comparatively long. I3 is relatively smaller and C1 relatively larger than in *P. ornatus*. A diastema between I3 and C is absent, although the two teeth are divergent at their apices. P2 is absent (Menzies and Pernetta, 1986). Molars are not strongly crenulated (George, 1987). The m2 has a well-developed paraconid on m2, and anterior cingulum extends lingual to the preprotocrista on the upper molars. Large, well-developed cingula occur between the lophs of the lower molars (Flannery et al., 1987).

**GENERAL CHARACTERS.** The Woodlark Island cuscus is a medium-sized phalangerid possum with a short, woolly pelage, a dark dorsal stripe, and pale ear flashes variably present (Flannery, 1994). Phalangerids are distinguished from other diprotodont marsupials by reduced exposure of the mastoid on the rear face of the cranium (Flannery et al., 1987) and a resulting non-tetrahedral geometry of the periotic (Norris, 1994); reduction or loss of P2 and enlargement of P1; and reduction or loss of fur on the distal portion of the tail, with at least partial development of dermal scales or tubercles (Flannery et al., 1987). Within the Phalangeridae, the genus *Phalanger* can be distinguished from *Ailurops*, *Strigocuscus*, *Wyulda*, and *Trichosurus* by expansion of the orbital wing of the maxilla; coarse and complex crenulation of the molars, with well-developed protoconules and metaconules; separation of the preprotocrista of M2 from the parastyle (Flannery et al., 1987); and possession of a phalangerin periotic morphology (Norris, 1994).

Fur color in *P. lullulae* is extremely variable, with mottled patterns of brown, ochre, and white which give the animal a marbled appearance. Light and dark morphs are recognized according to the proportions of brown/ochre to white fur. In light morphs, the predominant fur color is white/cream, with small patches of darker fur. These patches coalesce in the dark morphs to form broader expanses of dark fur, broken up with small white spots. The dorsal stripe is more pronounced in light morphs (Flannery, 1994). As in all species of *Phalanger*, the distal portion of the tail is naked. The furred portion of the tail terminates abruptly; the skin of the distal portion is dark in coloration and moderately rugose.

Females are slightly larger (on average) than males (Flannery, 1994). Mean external measurements (in mm) for five males and five females respectively, are as follows: length of head and body, 362, 367; length of tail, 310, 312; length of hind foot, 51.2, 46.5; length of ear, 20.3, 21.0; width of cranium across zygomatic arches, 49.1, 49.0. Mean weights (in g) for males and females are 1,495 and 1,770 respectively (Flannery, 1994).

**DISTRIBUTION.** The species is confined to Woodlark Island, Papua New Guinea (9°09'S, 152°46'E) and the neighboring island of Alcester (Fig 3; Flannery, 1995). The genus *Phalanger* had probably evolved by the Late Miocene or Early Pliocene (George, 1987). No fossils of *P. lullulae* are known.

**FORM AND FUNCTION.** Dental formula of *P. lullulae* is  $i\ 3/1, c\ 1/0, p\ 2/1, m\ 4/4$ , total 32: in addition, two or three small unicuspid teeth of unknown homology lie between  $i1$  and  $p3$  (Menzies and Pernetta, 1986). Upper and lower jaws bear a molariform P3 with a three-pointed crest; its symmetrical lateral faces are bounded by sharp, straight ridges. Molars are mildly crenulated; M2 is short and wide. The skull is pear-shaped and widest at the posterior end of the zygomata (Menzies and Pernetta, 1986). As with most phalangerids, with age caudal portions of the supraorbital ridges fuse to form a pronounced sagittal process. In *P. lullulae* the interorbital trough is broad and shallow. The lachrymal is broadly exposed on the face of the rostrum.

*P. lullulae* exhibits the typical characteristics of phalangerids, developed as adaptations to an arboreal life. Digits one and two are opposable against digits three, four and five. The tail is prehensile, and the distal portion of the tail is naked, to assist in gripping. The first and second digits of the pes are syndactylous, as is the case with all phalangerids (Flannery, 1994). Large paracloacal glands are present, which exude a sticky white secretion with a strong, metallic odor.



FIG. 2. Dorsal, ventral, and lateral views of the skull and lateral and dorsal view of the mandible of *Phalanger lullulae* (adult male, Natural History Museum, BMNH 96.11.5.25; paratype) from Woodlark Island, Papua New Guinea. Greatest length of skull is 61 mm.

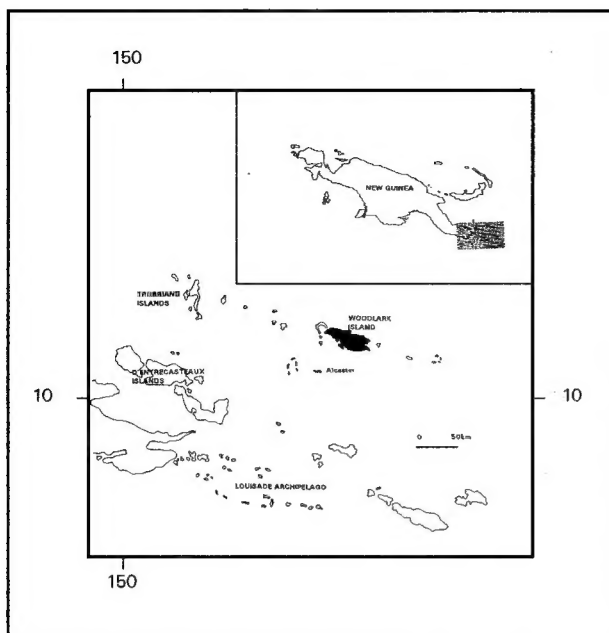


FIG. 3. Distribution of *Phalanger lullulae*.

**ONTOGENY AND REPRODUCTION.** During August 1987, five females of *P. lullulae* were captured on Woodlark and Alcester Islands (Flannery, 1994). Of these, one was parous, but lacked young; one showed evidence of lactation; two had naked pouch young; and one had a well grown back young. Thus breeding probably takes place over an extended period.

**ECOLOGY.** The Woodlark Island cuscus prefers lowland dry forest, both primary and secondary (Flannery, 1994). For this reason, the species is more abundant over the eastern half of Woodlark Island where this is the predominant vegetation type rather than in the denser, western rainforest. Local people claim that the animal feeds on two abundant species of vine, which have yet to be identified (Flannery, 1994). Evidence from other species of *Phalanger* suggests a more catholic diet, including fruit and even small animals (Flannery, 1994; Menzies and Pernetta, 1986).

*Phalanger lullulae* is the largest species of terrestrial mammal on Woodlark Island (Flannery, 1995). The only other species of arboreal mammal present on the island is the much smaller sugar glider (*Petaurus breviceps*), which feeds on a variety of foods, including fruits and beetle larvae (Hide et al., 1984). The most abundant mammalian frugivores in the forest canopy are bats, of which four species (*Dobsonia panniensis*, *Nyctimene major*, *Pteropus conspicillatus*, and *Pteropus hypomelanus*—Flannery, 1995) could be regarded as potential competitors with *P. lullulae*.

*Phalanger lullulae* is moderately abundant on Woodlark Island, even in areas which lie in close proximity to settlements. The animal is not known to raid gardens and is thus not regarded as a pest; it is, however, hunted for its meat. Hunting of the animal occupies a comparatively minor role in the culture of Woodlark Island's indigenous peoples, taking place only during the "gardening season" or when the sea is too rough for fishing (Flannery, 1994).

**BEHAVIOR.** Although there are no published records of behavior in *Phalanger lullulae*, a 1987 expedition by Oxford University to Woodlark Island, afforded the opportunity to make some observations (S. Haiselden et al., in litt.). Radio-tracking studies revealed a strong tendency for individuals to become localized in one area, containing a small number of sleeping trees, around which the animal's activity is centered. Animals sleep during the day, sheltering under epiphytes or in hollows within the tree, emerging shortly after nightfall to forage. The Woodlark Island cuscus is almost entirely arboreal, carrying out most of its foraging in the upper regions of the forest canopy, although nest sites may be lower down in the sleeping trees.

*P. lullulae* produces a wide range of vocalizations, including snarls, barks, and a whining cry which is not unlike the crying of

a human infant. These calls are particularly in evidence when individuals come into contact with one another while foraging; in general, the animals are solitary and intraspecific interactions are often aggressive. Mating behavior has not been observed.

**CONSERVATION STATUS.** Prior to 1987, the Woodlark Island cuscus was known from only eight specimens: six (including the Holotype) were collected by Meek in 1895; the remainder by the American Museum of Natural History's Fifth Archbold Expedition to New Guinea in 1956–1957. These specimens were all collected around Kulumadau, on the western half of the Island, which was formerly the main settlement. The Archbold Expedition reported the animal to be scarce (Brass, 1959), which led to fears that the species might be vulnerable to extinction (George, 1979) and its classification as "Vulnerable" by the IUCN (Thornback and Jenkins, 1982). In 1987, however, scientific expeditions from the Australian Museum and the University of Oxford found the animal to be moderately abundant in the eastern half of the island and a further sixteen specimens were collected by the two groups (Flannery, 1994). The species is still considered to be vulnerable by virtue of its restricted distribution.

**REMARKS.** The taxonomy of the Family Phalangeridae is complex and not entirely resolved, despite a number of recent revisions (Flannery et al., 1987; George, 1987; Menzies and Pernetta, 1986; Norris, 1992; Springer et al., 1990). The position of *P. lullulae* within the phalangerid phylogeny has also been the subject of some debate. On the basis of phenetic similarity, some authors favor a sister-group relationship with *P. ornatus*, a species endemic to Batjan island in the Moluccas (Menzies and Pernetta, 1986). This similarity may support the theory that the isolation of these two species on islands almost 2,000 km apart represents a relict distribution of a formerly widespread group of cuscuses. However, although *P. lullulae* and *P. ornatus* show superficially similar patterns of pelage coloration, *P. ornatus* shares a distinctive set of morphological synapomorphies with another Moluccan species, *P. rothschildi*, as well as with the widely-distributed ground cuscus, *P. gymnotis* (Flannery et al., 1987). These synapomorphies define a clade which is quite distinct from the other species of *Phalanger*, including *P. lullulae* (Norris, 1992). The distinctive spotted coat pattern of the Woodlark Island cuscus, together with the tendency for females of the species to exceed males in size, may suggest a sister-group relationship with the spotted cuscuses (subgenus *Spilocuscus*—Flannery, 1995). However, *P. lullulae* possesses none of the distinctive suite of dental and skeletal characters which defines this group. At present, the best consensus is that *P. lullulae* forms part of a clade within *Phalanger* which contains all the species of this genus, including those of the subgenus *Spilocuscus*, with the exception of *P. gymnotis*, *P. ornatus*, and *P. rothschildi* (Norris, 1992). The genetics of *P. lullulae* are unknown.

The generic name *Phalanger* is from the Greek for a spider's web, a reference to the webbed appearance of the animal's syndactylous hind foot. The specific designation *lullulae* is from the Latin for woodlark, in reference to the island where the species was first discovered (Thomas, 1896).

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